

QuikSCAT Coastal Wind Products

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ABSTRACT During the operational life of the QuikSCAT Ku-band ocean wind scatterometer, a ten year global ocean surface wind vector climate data record was produced at a temporal resolution of 12-24 hours. One of the most prominent gaps in the QuikSCAT climate data record is the lack of winds within 20 km of the coast. Due to computational efficiency issues that were much more important at the time of QuikSCAT's launch than now, measurements within 20 km of the coast were omitted to avoid land contamination. We have utilized two techniques to obtain winds closer to the coast: 1) Land Contamination Ratio (LCR) estimates the amount of land covered by each measurement and only throws out those that contain 1% or more land by effective area and 2) Land Contamination Ratio Expected Sigma-0 (LCRES) computes the land contribution to sigma-0 and excludes measurements with more than -24 dB land contribution. LCRES also corrects the backscatter data by subtracting the estimated land contribution. We have used LCR to retrieve winds globally for the entire operational QuikSCAT mission (1999-2009). The LCR retrievals are available from PODAAC as QuikSCAT version 3.1. The LCR data set extends to within 5-10 km of the coast for the entire globe. We have also retrieved winds using LCRES for all of calendar year 2005. We validate the new data sets by comparison with in situ data and numerical wind products and describe the characteristics of the coastal data that will make it useful for other researchers. RMS direction difference with respect to ocean-ward neighboring wind cells in the LCRES data set increases linearly from 5.5 degrees at 50-km from the coast to 11 degrees at 2.5-km from the coast. LCR direction differences are similar but max out at 9 degrees instead of 11. LCRES retrieves winds closer to the coast than does LCR. The number of LCR valid wind retrievals drops by 1/3 from 22-km from the coast to 10-km from the coast. LCRES retrieves as many winds at 5-km from the coast as LCR does at 10-km. Both LCR and LCRES experience modest 1 m/s increases in speed RMS difference and 0.5 m/s increase in speed bias w.r.t ocean-ward neighbors for data 5-km from the coast as compared to 30-km. The primary reason for this is likely land contamination in low wind (< 5 m/s) regimes where ocean backscatter is extremely small and thus more sensitive to land contamination. The QuikSCAT coastal wind data set will help to answer a number of open scientific questions where coastal wind forcing is important, including: what role ocean/land heat flux plays in global climate change and how biological productivity is affected by yearly and decadal cycles in ocean wind, among others. The work reported here was performed at the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration. © 2017. All rights reserved

QuikSCAT L2B Wind Product Version 3.1-LCR

- Land Contamination Ratio flagging
 - Removes backscatter measurements for which 1% or more of spatial resolution is over land.
 - Uses USGS land cover map with ~2-km resolution
- Retrieves wind from remaining measurements
- **Processed globally for ten years of QuikSCAT data and publicly available on PODAAC**

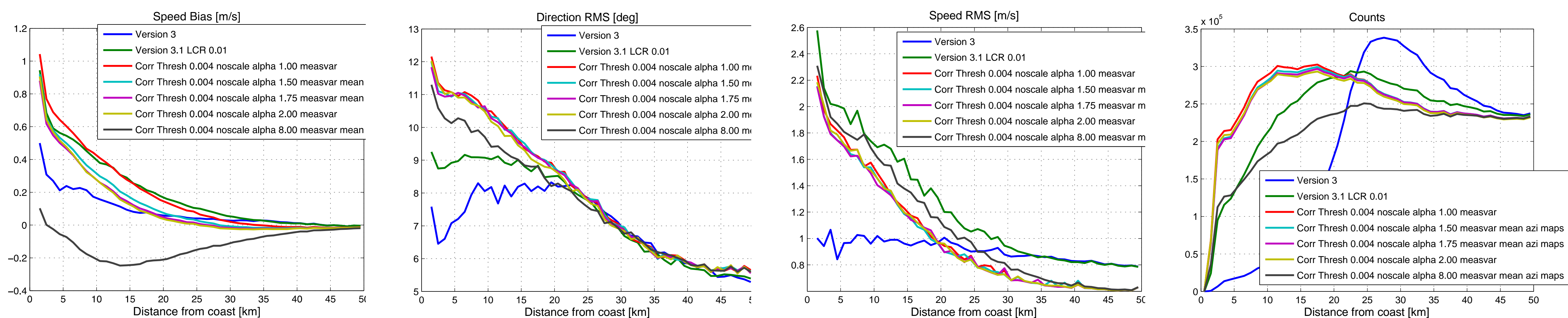
QuikSCAT L2B Wind Product Version 4.0-LCRES

- Land Contamination Ratio and Expected Sigma-0 flagging and correction
 - Removes backscatter measurements for which expected land contribution is more than 0.004 (-24 dB)
 - If less than threshold, estimates and corrects for expected backscatter contribution from land
 - Uses expected land sigma-0 map computed from QuikSCAT measurements over land.
 - Integrates expected land sigma-0 over each slice, multiplies by fudge factor alpha, and subtracts the result from measured sigma-0 value
- Retrieves wind from uncontaminated and corrected measurements
- Utilizes empirical variance rather than analytical variance in maximum likelihood estimator.
- **Processed globally for 2005 calendar year and currently being validated by Ted Strub's team at Oregon State and other interested parties.**

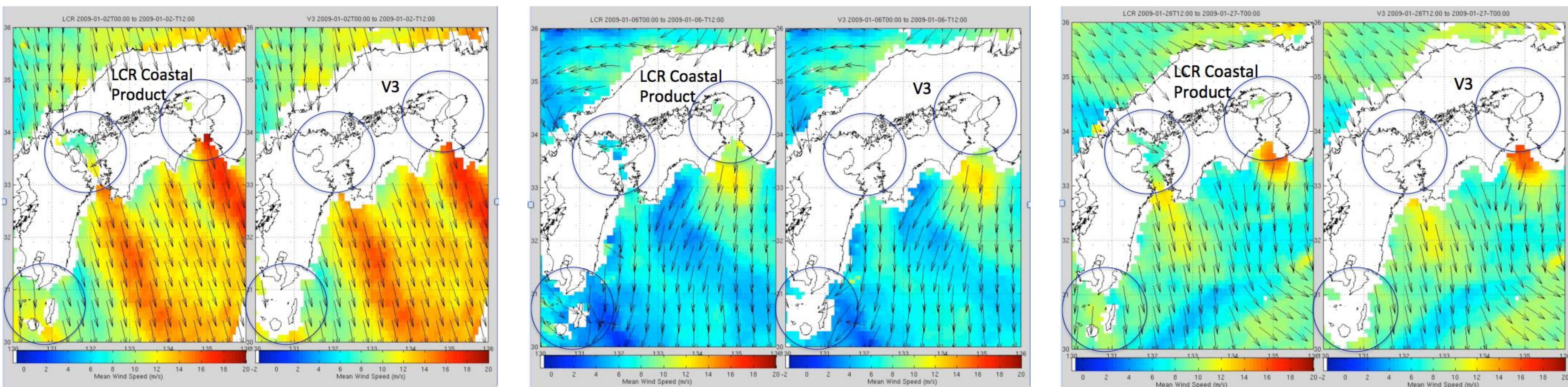
Future Plans

- Finish LRCES processing
- Complete Validation
- Deliver Version 4.0 to PODAAC
- Make Level 3 geographically gridded and quality checked product available

Wind statistics vs. distance from coast when compared to oceanward neighbors: **Original land mask, LCR, LCRES**



LCR to Original land flag comparison: (Southern Japan, Jan 2009) LCR fills in vectors in regions between the Japanese islands that are consistently omitted from the nominal product. Coastal winds are variable rather than persistently high as one would expect from land contamination.



LCRES to LCR comparison: (Southern Japan, Jan 2005), LCRES fills in more vectors near the coast. There are slight differences in the open ocean because the measured rather than theoretical variance is used in wind retrieval. This modification is necessary to account for residual error variance due to the land contamination correction. The open ocean RMS differences vs. ECMWF is similar for both variance formulations. Speed bias needs adjustment for measured variance.

